Description

Optical conductor connector, and a method for connection to the end of an optical conductor

The invention relates to an optical conductor connector having an optical conductor piece fixed in the factory in a ferrule, the end of the optical conductor directed outward being provided with a ground surface, and the end directed inward projecting from the ferrule and being connected by thermal welding to the inserted end of an optical conductor to be connected, the ferrule further being fixed in a ferrule holder.

Furthermore, the invention relates to a method for connecting this optical conductor connector to the end of an optical conductor.

Two groups of connectors, factory-fitted and field-mounting connectors, are known per se. Very good mechanical and optical properties can be achieved with factory-fitted connectors. It is thereby possible to assemble all types of fibers onto the corresponding connectors. The end faces of the connectors can be provided according to the requirements with all known sections such as, for example, 0°PC, APC or UPC. However, it is disadvantageous in this case that this type of connector must be provided with a piece of glass fiber (pigtail) whose length is mostly between 2.5 and 3 meters. The end of this glass fiber piece is then spliced onto the cable to be connected. However, this produces an additional connection, or splice point, which brings with it an additional loss in the transmission link. This connecting point must then additionally be surrounded by an appropriate mechanical guard.

In the case of "field-mounting connectors", it is advantageous that the cable to be connected can be

connected directly to the connector. This eliminates the additional splice, and also the additional mechanical guard. A plurality of systems of field-mounting connectors are known. In the case of a bonded connector, the optical conductor is bonded in an appropriate receptacle and the end face is subsequently ground and polished. However, with some types of section this grinding and polishing operation is very difficult, or even cannot be executed at all. In the case of what are termed spliced connectors, a synthesis of factory-fitted and field-mounting connectors is undertaken. With these connectors, the difficult part of bonding in the optical conductors, and the grinding of the end face are already carried out in the factory, and the connection, or splicing on of the optical conductor to be connected is then executed on site during the actual field assembly. In principle, this type of connector corresponds to a factory-fitted connector, but no additional outlay is required here to protect the splice point, because the splice is located directly in the connector. Such a type of connector is known by the name of "FuseLite connector". In the case of such a "FuseLite connector", use is made of a factory-fitted ferrule with a bonded optical conductor that is ground at the end face and in the case of which an optical conductor piece projects on the second end face. The optical conductor to be connected is mounted directly onto this optical conductor piece by thermal splicing inside the connector housing. This means that in this region the connector must have appropriate cutouts through which the arc must be guided for welding. This means that in this region the connector must consist of a material of high quality that is exceptionally heat resistant. This material is not permitted to warp at the existing high temperatures, since otherwise it is impossible to achieve the required splice quality. A high quality ceramic, for example zirconium, is used as material for this purpose.

German laid-open application DE 19517750 discloses an optical conductor connector in the case of which the end of an already permanently fixed piece of optical conductor is connected by thermal welding in a connecting sleeve to the end of an optical conductor to be connected. Recessed into the connecting sleeve for this purpose are lateral openings through which the welding electrodes are led up to the splice point.

It is the object of the present invention to create a field mounting optical conductor connector in the case of which the above-named difficulties relating to splicing are simplified, and in the case of which it is also possible to make use in the splice region of materials not of such high quality. The object set is achieved with the aid of an optical conductor connector of the type explained at the beginning, by virtue of the fact that the ferrule with the fixed optical conductor can be detached from the ferrule holder before the thermal welding of the optical conductor end, in that the ferrule is pressed into a receptacle of the ferrule holder after the thermal welding, in that a basic housing with an axially operating compression spring is arranged over the ferrule holder, in that a crimping ring for fixing the stress member of the optical conductor is pressed on the basic housing, in that an anti-kink guard is applied over the cladding of the optical conductor to be connected, and over the end of the basic housing, and in that an outer housing with latching elements is drawn on as a cover.

Furthermore, the object arises with the invention of developing a method for connecting the connector according to the invention to the end of an optical conductor. This object set is achieved with the aid of the method according to the features of claim 5.

Owing to the design of the optical conductor connector according to the invention, it is to be emphasized as a particular advantage by comparison with the prior art that splicing the optical conductor piece held in a ferrule onto the end of the optical conductor to be connected can be executed not inside a connector housing, but separately outside thereof. In addition, it is now possible also to make use of a normal optical splicer for the thermal welding of the optical conductor ends. This means that a specially modified splicer that must be tuned to the geometry of the connector housing need not be used, as previously customary, for the splicing. Moreover, the welding takes place outside the ferrule, and so the material of the ferrule is no longer exposed to the high temperatures during the thermal welding operation. After the welding operation, the optical conductor connector is then assembled, the ferrule firstly being pressed into a receptacle in a ferrule holder and thereby fixed exactly in position. Subsequently, the further individual parts of the optical conductor connector, which have previously already been pushed in the appropriate sequence onto the optical conductor to be connected, are positioned over the ferrule and the ferrule holder. This completely eliminates the expensive splicing by welding inside the optical conductor connector, and/or a ferrule specially modified therefor and a splicer also specifically created therefor. The splicing is therefore a routine mounting operation such as is otherwise also carried out in the case of any thermal optical conductor splicing between two optical conductor ends. The design of the optical conductor connector described therefor also simultaneously characterizes the method according to the invention, in accordance with which the optical conductor connector is assembled after the finished thermal welding of the optical conductor ends. It is particularly advantageous in the case of the method that the splicing is performed before the assembly of

the optical conductor connector, using the distances and dimensions prescribed by the individual parts. Consequently, all the positions of the individual parts are already prescribed for the assembly at this first operation.

The invention will now be explained in more detail with the aid of four figures, in which:

figure 1 shows the finally mounted optical conductor connector,

figure 2 shows the optical conductor connector according to figure 1, in a longitudinal section,

figure 3 shows the basic housing of the optical conductor connector with inserted ferrule, and

figure 4 illustrates the cycle of the method according to the invention for producing the thermal welding of the optical conductor ends, and for mounting the optical conductor connector.

The optical conductor connector in accordance with the invention is illustrated in the assembled state in figure 1. It therefore shows the ferrule 2, which is inserted into a basic housing 11, and in which the optical conductor piece 2a required for splicing is centrally arranged. The end faces 3 of the ferrule 2 and of the optical conductor piece 2a have already been provided at the factory with a suitable section such as, for example, with one of the types of section 0°PC, APC, UPC, which are known per se, such that no complicated and difficult work need any longer be executed when actually mounting the connector. An outer housing 1, which is provided with the corresponding latching elements 20a for fixing the optical conductor

connector, is mounted over the basic housing 11. The anti-kink guard 13 projects at the opposite end of the optical conductor connector. Also indicated is a section II-II, which is explained in figure 2.

Figure 2 shows the entire inner design of the optical conductor connector according to the invention, the optical conductor connector already being finished at the splice point 15. It follows therefrom that the ferrule 2 with the optical conductor piece 2a already inserted at the factory, and with the end face 3, likewise provided with the desired section in the factory, is pressed after splicing has been performed in a receptacle 18 of the ferrule holder 9 and thereby fixed. Located inside a bore 9a in the ferrule holder 9 are the ends, connected to one another at the splice point 15, of the optical conductor piece 2a and of the optical conductor 6 to be connected, which is freed from its coating 7 in the welding point region. The stress members 8, for example Kevlar fibers, of the optical conductor 14 are fixed at the end of the basic housing 11 with the aid of a crimping ring 12. The basic housing 11 is secured in its position with the ferrule 9 by resilient latching elements 19. A pressure spring 10, which ensures the required contact pressure with the connector inserted, is drawn on a rear step of the basic housing 11. Also illustrated is the anti-kink guard 13, which prevents impermissible kinking of the inserted optical conductor 14. It may also be seen that the cladding 17 has been provided during mounting with longitudinal slots 17a.

Illustrated in figure 3 is the basic housing 11 with a latching element 20b which serves for latching into the outer housing, which surrounds it later. Also illustrated is the inserted ferrule 2 with the optical conductor piece 2a and the ground end face 3.

It follows from figure 4 how the individual parts of the optical conductor connector are combined for mounting before the splicing operation, and so the method according to the invention can also be derived from this illustration. Thus, the cladding 17 of the optical conductor cable 14 is provided on a length of approximately 20 mm with longitudinal slots 17a such that the stress members 8 of the optical conductor 14 can be gripped. Moreover, the optical conductor 14 is freed from its coating in the region of the welding point 15 over a length of approximately 8 mm. The anti-kink guard 13, the crimping ring 12 and the basic housing 11 are now pushed in sequence over the cladding 17 of the optical conductor 14. The ferrule holder 9 with the pressure spring 10 mounted at the rear is pushed on under the cladding 17 opened by longitudinal slots 17a, the optical conductor still projecting with its coating 7 over a length of approximately 10 mm. The optical conductor 14 to be connected is thereby prepared for splicing over a total length of approximately 38mm with the end of the optical conductor piece 2a projecting in the ferrule 2. The end, prepared with the individual parts, of the optical conductor 14 is now laid into a completely normal thermal optical conductor splicer SG, known per se and illustrated here only symbolically, and fixed in its position with clamps E. From the other side of the optical conductor splicer SG, the optical conductor piece 2a already fixed in the ferrule 2 in the factory is pushed in the opposite direction up to the splice point 15 and likewise fixed with clamps E, the length of the projecting optical conductor piece 2a being approximately 6 mm. The dimensions in this figure are to be regarded only as examples and are, of course, to be adapted as appropriate in each case to the optical conductor connector used. After the thermal splicing has been carried out in the way known per se, the ferrule holder 9 is pushed against the ferrule 2, the latter being pressed into and fixed in a receptacle 18

(see figure 2). The splice point 15, and also the exposed optical conductor ends are thereby accommodated in a protected fashion in the bore of the ferrule holder 9. This design and mounting operation according to the invention renders it possible to make use of a commercially available optical conductor splicer. Subsequently, the remaining individual parts previously pushed on are then arranged over the ferrule holder 9, the stress members 8 of the optical conductor 14 additionally being clamped and fixed on the ferrule holder by the crimping ring 12. It is also expedient for the ferrule holder 9 also to be pushed in further a little by approximately 2 to 3 mm below the unslotted cable cladding 17.

These measures according to the invention have rendered it possible for the welding point certainly to be situated inside the optical conductor connector when the optical conductor to be connected is spliced on, without the need to provide special bores or cutouts for the welding operation in the ferrule. This simplifies the ferrule very greatly, since, firstly, there is no need to use high-temperature resistant material and, secondly, a simple sleeve shape is completely sufficient. It is advantageous, in addition, that this method also requires no modification or reconfiguration of optical conductor splicers.